

**Abstract**

A method is provided for forming a power semiconductor device. The method begins by providing a substrate of a first conductivity type and then forming a voltage sustaining region on the substrate. The voltage sustaining region is formed by depositing an epitaxial layer of a first conductivity type on the substrate and forming at least one trench in the epitaxial layer. At least one doped column having a dopant of a second conductivity type is located in the epitaxial layer, adjacent a sidewall of the trench. The trench is etched using an etchant gas that also serves as a dopant source for the formation of the doped column. For example, if a p-type dopant such as boron is desired, BCl<sub>3</sub> may be used as the etchant gas. Alternatively, if an n-type dopant such as phosphorus is required, PH<sub>3</sub> may be used as the etchant gas. The dopant present in the gas is incorporated into the silicon defining the surfaces of the trench. This dopant is subsequently diffused to form the doped column surrounding the trench. The trench is filled with an insulating material such as silicon dioxide, silicon nitride, polysilicon, or a combination of such materials. The step of filling the trench may be performed before or after the dopant is diffused to form the doped column. Finally, at least one region of the second conductivity type is formed over the voltage sustaining region to define a junction therebetween.